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A NEW GENUS AND TWO NEW SPECIES OF GALL MIDGE (DIPTERA: CECIDOMYIIDAE) DAMAGING YOUNG BRANCHES OF *EUCALYPTUS* SPP. IN SOUTH AUSTRALIA

by Peter Kolesik*

Summary

Kolesik, P. (1998) A new genus and two new species of gall midge (Diptera: Cecidomyiidae) damaging young branches of *Eucalyptus* spp. in South Australia. *Trans. R. Soc. S. Aust.* **122**(2), 45-53, 29 May, 1998.

Two new gall midges are described from galls on young branches of two *Eucalyptus* species in South Australia and a new genus, *Okriomyia*, is described to contain them. The new genus belongs to the tribe Asphondyliini and the subtribe Schizomyiina. It differs from other Schizomyiina in the shape of the aedeagus, the solid tooth of the gonostylus and the cerci-like female tenth tergite. *Okriomyia schwarzi* gen. et sp. nov. was found on *Eucalyptus gracilis* and *O. flabellidentata* sp. nov. on *E. cosmophylla*. Infested branches fracture at the site of the gall as the trees mature. Males, pupae, and larvae of both species and the female of *O. schwarzi* are described. The new species differ from each other in the morphology of the male genitalia, the pupal face, and the pupal prothoracic spiracle. A key to the Australian genera of the tribe Asphondyliini is given.

Key Words: Gall midge, Cecidomyiidae, *Okriomyia schwarzi*, *Okriomyia flabellidentata*, *Eucalyptus gracilis*, *Eucalyptus cosmophylla*, South Australia.

Introduction

Eucalyptus, the dominant genus of most Australian woodlands and forests, hosts a whole suite of gall-forming insects, many of them undescribed. The present paper describes two gall midges, new to science, which were found damaging young branches of two eucalypts in South Australia. Galls of *Okriomyia schwarzi* sp. nov. on *Eucalyptus gracilis* F. Muell. (Fig. 1) were found at two localities: Nadda, in the southern part of South Australia near the Victorian border and Forestville, a suburb south-west of Adelaide. Galls of *O. flabellidentata* sp. nov. on *E. cosmophylla* F. Muell. (Fig. 2) were found at Cleland Conservation Park, near Adelaide. The newly-described gall midges were found only in moderate abundance. However, heavy infestations could have the potential to impact seriously on the population dynamics of their hosts, since the infested branches fracture at the site of the galls as the trees mature.

Eucalyptus gracilis is a 3 - 12 m high shrub or tree distributed through the mallee belt of continental southern Australia. It is an arid zone species useful for firewood and erosion control and is highly regarded for honey production (Cunningham *et al.* 1981; Chippendale 1988). It is often used in urban planting.

Fig. 1. Gall of *Okriomyia schwarzi* sp. nov. on young branch of *Eucalyptus gracilis*. Scale bar = 20 mm.

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Fig. 2. Gall of *Okriomyia flabellidentata* sp. nov. on young branch of *Eucalyptus cosmophylla*. Scale bar = 20 mm.

Eucalyptus cosmophylla is a South Australian shrub or tree, usually 5 - 10 m high, that occurs from the Mount Lofty Range to the Fleurieu Peninsula and Kangaroo Island in open shrubland, low, open forest and heathland near the sea (Chippendale 1988). It is widely used in urban planting.

The new gall midges do not resemble any known genus so a new genus has been erected for them. *Okriomyia* becomes Australia's fourth known genus of the tribe Asphondyliini and the third of Schizomyiina, a subtribe consisting exclusively of genera endemic to Australia. A key to the Australian genera of Asphondyliini is given in the present paper.

Material and Methods

Galls on branches of *Eucalyptus gracilis* were collected at Forestville (19.ii.1993) and Nadda (12.vii.1996). Two, one, three, four and one galls from branches of *E. cosmophylla* were collected at Cleland and Morialta Conservation Parks 27.xi.1992, 23.i.1993, 5. and 12.iii.1995, and 23.ii.1997, respectively. In the laboratory the galls were cut open and the larvae processed in two ways. A small number was preserved in 70% ethanol. A larger number was transferred into rearing pots where the larvae dug themselves into wet sand. Pupation took place in the sand. Several males and females emerged from the galls from *E. gracilis*. Of the galls collected from *E. cosmophylla* adults emerged only from the sample collected on 23.ii.1997 - 12 males and no females. Emerged adults were preserved together with their pupal skins in 70% ethanol. Microscope mounts of the type series were prepared according to the technique outlined by Kolesik (1995a). The type series and other material retained in 70% ethanol, together with dried galls, are deposited in the South Australian Museum, Adelaide [SAMA], the Australian National Insect Collection, Canberra [ANIC] and the State Herbarium of South Australia, Adelaide [SHSA]. Descriptions and measurements refer to the holotypes and paratypes. Terminology of adult morphology follows that of Gagné (1981); larval terminology follows that of Gagné (1989).

Genus ***Okriomyia*** gen. nov.

Type species: *Okriomyia schwarzi* sp. nov.

Adults

Head. Eye facets hexagonoïd, eye bridge 6 - 8 facets long medially. Antenna with 12 flagellomeres, distal ones not shortened. Flagellomeres cylindrical, sessile, first and second not fused, with short setae and bearing low, finely reticulate circumfila. Scape as long as wide, pedicel half as long as wide. Labella hemispherical, each with several setae. Palpus with 4 segments.

Thorax. Wings: R_5 joining C at apex, slightly bowed anteriorly, Rs absent, R_1 joining C near mid-length, Cu forked. First tarsomere lacking ventro-distal spine, tarsal claws simple, as long as empodia.

Abdomen. Tergites 1 - 8 with setae evenly distributed, forming dense row posteriorly. Sternum 1 not sclerotized, asetose; sternites 2 - 8 with setae in two separate areas: wide, anterior field and narrow, posterior band. Female abdominal sternite 7 1.5 x sternite 6. Male terminalia: gonocoxite with apico-ventral lobe; gonostylus short and wide, with tooth in form of serrate plate no more strongly pigmented than remainder; cercus bilobed, deeply divided medially, emarginated posteriorly, with several posterior setae; parameres small, setose; hypoproct with posterior margin concave, each lateral lobe with 1 - 2 apical setae; aedeagus comprising two parts: dorsal part robust, conical, ventrally covered with sclerotized villi on apical third, ventral part smooth, thin in lateral view, shallowly emarginated apically in dorso-ventral view, asetose. Female terminalia: ovipositor short, fleshy; tergum 9 and sternum 9 sclerotized; tergum 10 in form of two large, cerci-

like lobes, more sclerotized anteriorly, evenly setose; cerci large, discrete, more sclerotized posteriorly, evenly setose; hypoproct small, bilobed, each lobe with apical seta.

Pupa

Antennal horns strongly pigmented; cephalic swellings, facial protuberances, prothoracic spiracle, dorsal spines of abdomen slightly pigmented; abdominal skin not pigmented. Antennal horns blunt on anterior surface, produced antero-ventrally into an acute ridge. Cephalic sclerite with pair of swellings shorter than antennal horns. Cephalic pair of papillae with long setae. Frons with one or two sclerotized protuberances on each side, one of two lower facial papillae with seta, one of three lateral papillae with seta. Abdominal segments 1 - 7 with pair of setose ventral papillae, 2 pairs of setose pleural papillae, 2 pairs of asetose and pair of setose dorsal papillae. Abdominal segment 8 with pair of ventral papillae, 2 pairs of pleural papillae, pair of dorsal papillae, all setose. Abdominal segments 2 - 8 dorsally with field of strong, one- or two-pointed spines on anterior half.

Larva

Integument covered with tiny, sparse spicules. Head: strongly sclerotized, postero-lateral apodemes longer than head capsule, antennae 2 x longer than basal width. Neck segment with pair of dorsal papillae. Thoracic segments with pair of ventral papillae, 2 pairs of pleural papillae, pair of sternal papillae, 3 pairs of lateral papillae, 2 pairs of dorsal papillae. Spatula bilobed, with shaft. Abdominal segments 1 - 7 with pair of ventral papillae, 2 pairs of pleural papillae, 3 pairs of dorsal papillae. Abdominal segment 8 with pair of ventral papillae, 2 pairs of pleural papillae, pair of dorsal papillae. Terminal segment with pair of anal papillae on short lobes, pair of terminal papillae on prolonged lobes. All papillae asetose.

Etymology

The prefix "Okrio-" is from the Greek *okrios*, meaning roughness, referring to the jagged ventral surface of the aedeagus and distinguishing the new genus from other Schizomyiina. The suffix "-myia" is Greek for fly.

Remarks

Okriomyia gen. nov. belongs to the tribe Asphondyliini on the basis of the following shared apomorphies: the presence of a ventro-apical lobe on the gonocoxite with gonostylus consequently situated dorso-ventrally; the short, quadrate gonostylus, the presence of parameres; and the large female sternite 7 that is 1.5 x as long as sternite 6. The new genus belongs to the subtribe Schizomyiina because it lacks a ventro-apical spine on the first tarsomere, has male parameres, has a short, fleshy ovipositor and the pupal integument is unpigmented. The new genus is unique among the Schizomyiina because of the divided aedeagus, the solid tooth on the gonostylus and the cerci-like female tergum 10. The Australian genus, *Eucinciticornia* Felt, the only other genus associated with galls on *Eucalyptus* spp. (Kolesik 1995a), most closely resembles *Okriomyia* gen. nov. *Okriomyia* shares with *Eucinciticornia* the long lobes on the terminal larval segment and the fleshy ovipositor with divided cerci, which represents the most plesiomorphic ovipositor in Asphondyliini.

The tribe Asphondyliini is known in Australia from 12 species distributed among four genera. *Asphondylia* Loew, a large, cosmopolitan genus, belonging to the subtribe Asphondyliina, contains seven species: *A. anthocercidis* Kolesik (Kolesik *et al.* 1997), *A. dodonaeae* Kolesik (1995c), *A. eriiformis* Kolesik (1997), *A. lilli* Edwards (1916), *A. inflata* Kolesik (1997), *A. loewi* Skuse (1888) and *A. rubicunda* Skuse (1888). The other three genera, all belonging to the subtribe Schizomyiina, are known only from Australia and contain five species: *Eucinciticornia australasiae* Felt (1915), *E. malarski* Kolesik (1995a), *Skusemyia allocasuarinae* Kolesik (1995b) and the new species, *Okriomyia schwarzi* and *O. flabellidentata*.

Key to Australian genera of Asphondyliini

1. First tarsomere with spur; male paramere absent; female with pair of dorsal lobes at base of needle-like ovipositor; pupal skin completely pigmented ..... *Asphondylia*
   First tarsomere without spur; male paramere present; female without pair of dorsal lobes at base of ovipositor or ovipositor not needle-like; pupal skin not pigmented on at least abdomen 2

2. Three terminal female flagellomeres successively and progressively shorter; ovipositor needle-like; male parameres large, as wide as posterior lobes of cerci; pupal cephalic swellings longer than antennal horns ..... *Skusemyia*
   Three terminal female flagellomeres subequal in length; ovipositor short, fleshy, with unfused cerci; male parameres small, much narrower than posterior lobes of cerci; pupal cephalic swellings shorter than antennal horns 3

3. Tooth on gonostylus consisting of several separate teeth; female with pair of small dorsal lobes posterior to eighth tergite; largest dorsal spines on pupa serrated apically ..... *Eucinciticornia*
   Tooth on gonostylus solid, in form of a plate; female without pair of dorsal lobes posterior to eighth tergite; dorsal spines on pupa one- or two-pointed ..... *Okriomyia*

Okriomyia schwarzi sp. nov.
(FIGS 1, 3-6, 10-23, 27-30)

Holotype: ♂, Nadda, South Australia [34° 37' S, 140° 53' E], 13.viii.1996, reared by P. Kolesik from branch gall on *Eucalyptus gracilis* F. Muell., larva collected 12.vii.1996 by J. Schwarz, 121338 [SAMA].
Paratypes: 2 ♂♂, 3 ♀♀, 4 pupal skins [SAMA, 121339-121347], 2 ♂♂, 2 ♀♀, 3 pupal skins [ANIC], same data but emerged 12.-20.viii.1996; 3 larvae [SAMA, 121348-121350], 2 larvae [ANIC], collected with holotype.

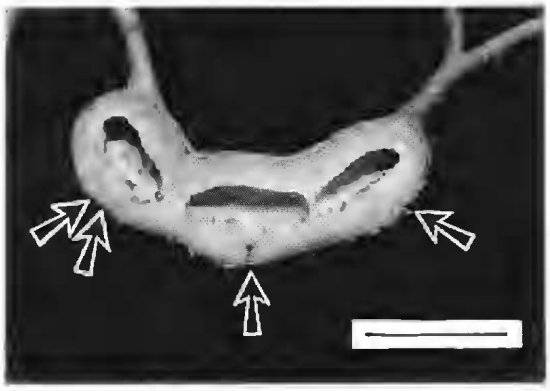


Fig. 3. Gall of *Okriomyia schwarzi* sp. nov. on *Eucalyptus gracilis* – longitudinal section. Arrows mark larval exit holes. Scale bar = 10 mm.

Other material [SAMA]: 4 ♂♂, 24 ♀♀, 23 pupal skins, 3 pupae, same data; 17 larvae, gall, collected with holotype; 2 ♀♀, 2 pupal skins, Forestville, South Australia [34°56' S, 138°36' E], 23.iii.1993, P. Kolesik, reared from branch galls on *E. gracilis*, larvae collected 19.ii.1993; 4 galls, collected with holotype [SHSA].

Description
Male (Figs 4-6, 10-15)
Colour: antennae grey; head black; thorax brown; legs yellow; abdomen with sclerotized parts and setae black, non-sclerotized parts orange. Wing length 2.2 mm (1.9 – 2.5). Genitalia: gonocoxite covered with short setae, with 2 short, thin, posterior, dorso-medial lobes; apico-ventral lobe on gonocoxite long, aciculate; tooth on gonostylus narrow, finely serrated; aedeagus narrow distally in lateral view; hypoproct with large lobes, as long as aedeagus.

Female (Figs 16-20)
Wing length 3.0 mm (2.8 - 3.3). Circumfila on flagellomeres about half density of male ones. Abdominal sternite 7 1.5 x (1.3 -1.6) longer than sternite 6. Setae on cerci 2 x shorter and much denser than on tergite 10. Ovipositor as long as tergites 7 and 8 together. Colour as in male.

Pupa (Figs 21-23)
Colour: Antennal horns brown, cephalic swellings, facial protuberances, prothoracic spiracle, dorsal spines pale brown, abdominal skin grey. Total length 4.3 mm (3.8 – 4.6). Antennal horns 86 µm (77 - 109) long. Cephalic setae 161 µm (138 - 181) long. Cephalic swellings 46 µm (36 - 65) long. Upper face with 2 pairs of sclerotized protuberances, inner pair 51 µm (48 - 54) long, outer pair 30 µm (29 – 38). Setae on lower facial papillae 122 µm (103- 143) long. Prothoracic spiracle with slight, gradual curve, 244 µm (206 – 267) long, trachea ending at apex.

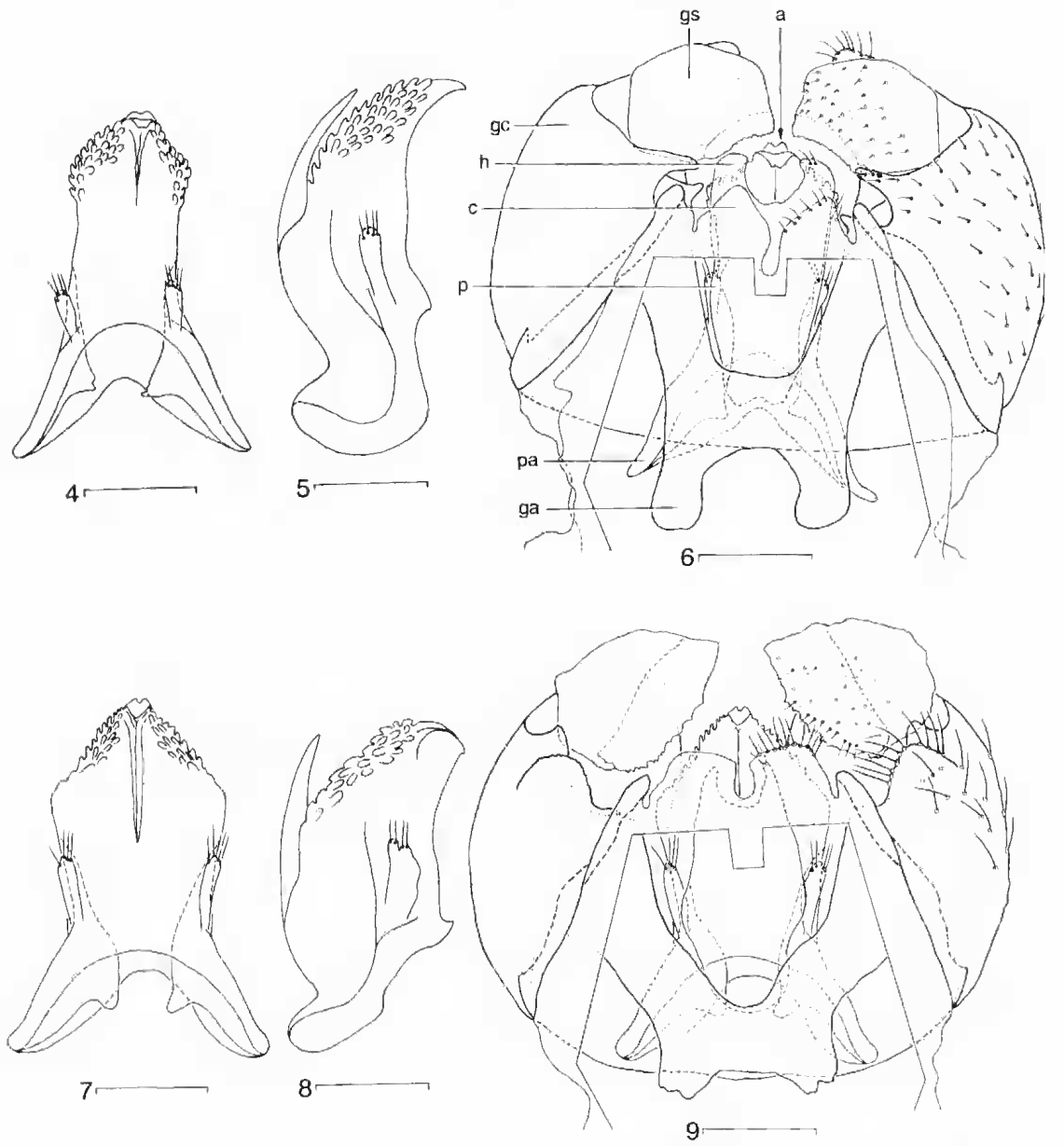
Larva (Figs 27-30)
Colour: pink to orange. Total length 5.9 mm (4.3 - 7.8). Head capsule width at base 92 µm (90 – 94), length 70 µm (63 – 74), length of postero-lateral apodemes 116 µm (110 - 127). Antenna 26 µm (25 - 27) long. Sternal spatula 445 µm (361 - 543) long, with apical enlargement 100 µm (83 – 130) wide, depth of incision 46 µm (29 - 68). Terminal lobes 160 µm (113 – 233) long.

Etymology
The species is named after the collector of the larval stage of the type specimens, Julie Schwarz, Department of Plant Science, University of Adelaide.

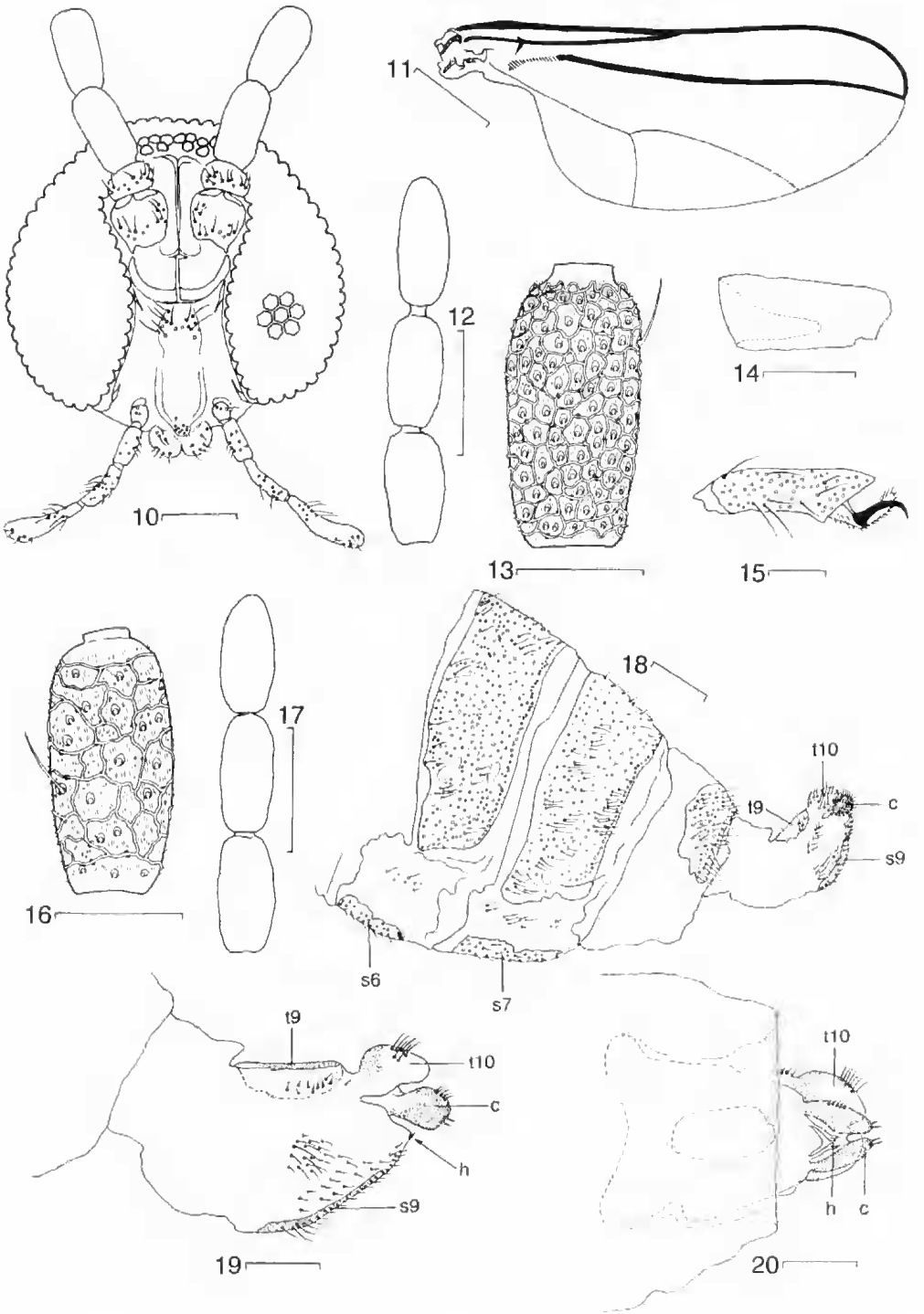
Gall and biology
Young branches of *Eucalyptus gracilis* are swollen to form galls 8 – 20 mm in length and 7 - 9 mm in diameter, with outer walls 1 – 3 mm thick (Fig. 1). The gall outer surface is scabrous, reddish brown in colour. Inside there are 1 - 5 ovoid chambers, each occupied by 1 - 13 larvae. Larval colour may vary from pink to orange between chambers of the same gall but is the same within a chamber. No association between the colour and the age of larvae was apparent. Gall walls contain less woody tissue than unaffected parts of the branch, which results in the gall being springy to the touch and crunchy when cut with a knife. This characteristic is shared with galls of *O. flabellidentata*. When the larvae are fully grown, they leave the galls through one or two circular openings that develop in each chamber (Fig. 3). Pupation takes place in the soil.

Okriomyia flabellidentata sp. nov.
(FIGS 2, 7-9, 24-26, 31-34)

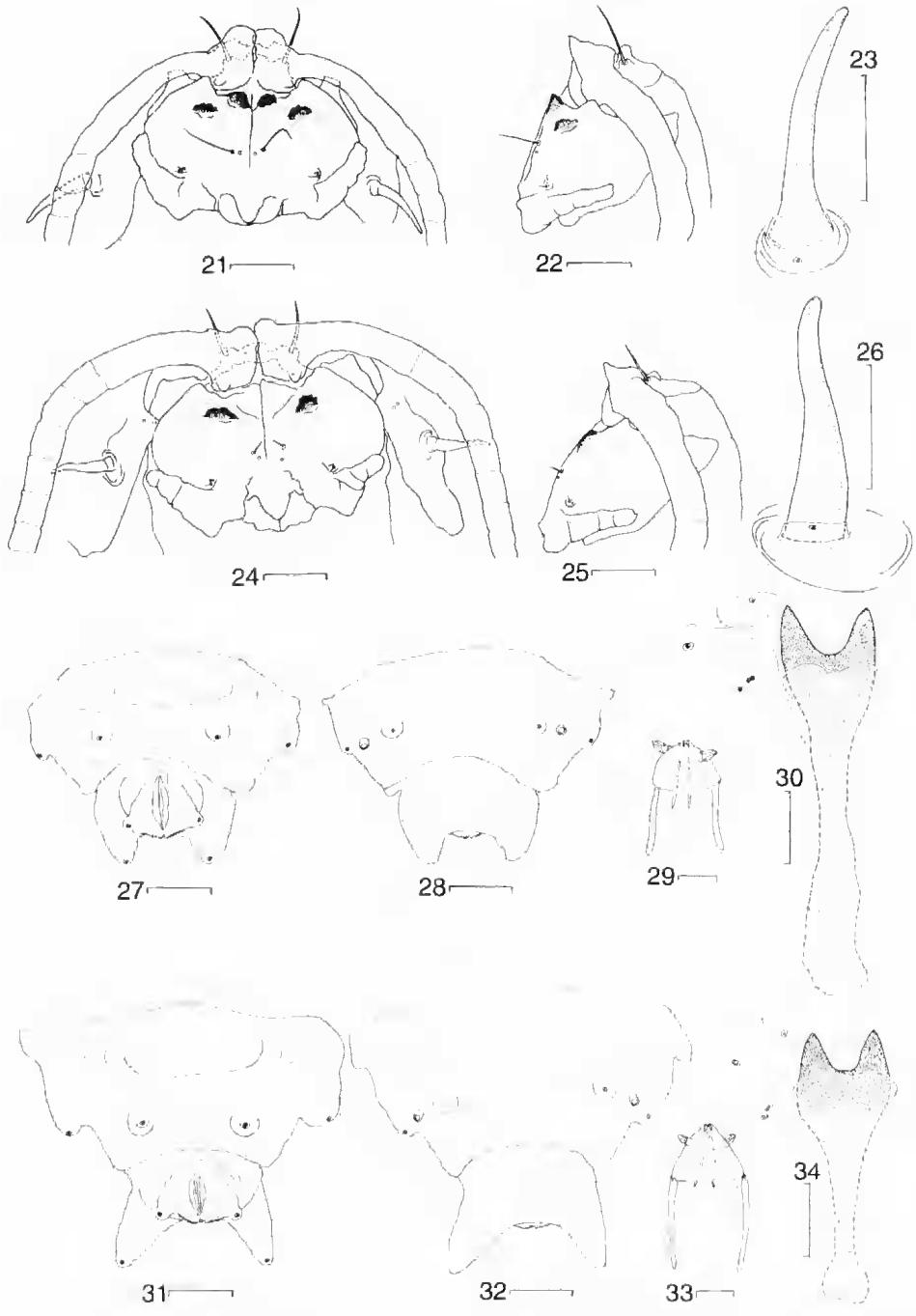
Holotype: ♂, Cleland Conservation Park, South Australia [34° 58' S, 138° 42' E], 15.iii.1997, P. Kolesik, reared from branch gall on *Eucalyptus*



Figs 4-6. Male of *Okriomyia schwarzi* sp. nov. Fig. 4. Aedeagus in frontal view. Fig. 5. Aedeagus in lateral view. Fig. 6. Genitalia in dorsal view (inner part of cerci diagrammatically cut out for better clarity). Figs 7-9. Male of *Okriomyia flabellidentata* sp. nov. Fig. 7. Aedeagus in frontal view. Fig. 8. Aedeagus in lateral view. Fig. 8. Genitalia in dorsal view (inner part of cerci diagrammatically cut out). Scale bars = 100 µm. Abbrev.: a, aedeagus; c, cercus; ga, gonocoxal apodeme; ge, gonocoxite; gs, gonostylus; h, hypoproct; ö, paramere; pa, parameral apodeme.



Figs 10-20. *Okriomyia schwarzi* sp. nov. 10-15 male, 16-20 female. Fig. 10. Head in frontal view. Fig. 11. Wing. Fig. 12. Last three flagellomeres. Fig. 13. Sixth flagellomere. Fig. 14. First tarsomere. Fig. 15. Last tarsomere with claw and empodium. Fig. 16. Sixth flagellomere. Fig. 17. Last three flagellomeres. Fig. 18. End of abdomen in lateral view. Fig. 19. Ovipositor in lateral view. Fig. 20. Ovipositor in ventral view. Scale bars = 100 µm 10, 12, 17, 19, 20; 500 µm 11; 50 µm 13-16; 200 µm 18. Abbrev.: c, cercus; h, hypoproct; s, sternite; t, tergite.



Figs 21-23. Pupa of *Okriomyia schwarzi* sp. nov. Fig. 21. Anterior part in dorsal view. Fig. 22. Anterior part in lateral view. Fig. 23. Prothoracic spiracle. Figs 24-26. Pupa of *Okriomyia flabellidentata* sp. nov. Fig. 24. Anterior part in dorsal view. Fig. 25. Anterior part in lateral view. Fig. 26. Prothoracic spiracle. Figs 27-30. Larva of *Okriomyia schwarzi* sp. nov. Fig. 27. Eighth and terminal abdominal segments in ventral view. Fig. 28. Eighth and terminal abdominal segments in dorsal view. Fig. 29. Head in ventral view. Fig. 30. Spatula with adjacent papillae. Figs 31-34. Larva of *Okriomyia flabellidentata* sp. nov. Fig. 31. Eighth and terminal abdominal segments in ventral view. Fig. 32. Eighth and terminal abdominal segments in dorsal view. Fig. 33. Head in ventral view. Fig. 34. Spatula with adjacent papillae. Scale bars = 200 µm 21, 22, 24, 25, 27, 28, 31, 32; 100 µm 23, 26, 30, 34; 50 µm 29, 33.

cosmophylla F. Muell., larva collected 23.ii.1997, 121351 [SAMA].

Paratypes: 2 ♂♂, 3 pupal skins [SAMA, 121352-121356], 2 ♂♂, 3 pupal skins [ANIC], same data but emerged 15.-17.iii.1997; 3 larvae [SAMA, 121357-121359], 2 larvae [ANIC], collected with holotype.

Other material [SAMA]: (all collected from branch galls on *E. cosmophylla* by P. Kolesik): 7 ♂♂, 4 pupal skins, same data but emerged 1.-14.iv.1997; 12 larvae, gall collected with holotype; 3 larvae, Morialta Conservation Park [34° 54' S, 138° 44' E], 27.xi.1992; 9 larvae, Cleland Conservation Park, 5. & 12.iii.1995; gall, Cleland Conservation Park, 23.i.1993 [SHSA].

Description

Male (Figs 7-9)

Colour: as in *O. schwarzi*. Wing length 2.9 mm (2.7 – 3.0). Genitalia: gonocoxite covered with long setae, with two short, postero-dorsal lobes, one thin, one wide; apico-ventral lobe on gonocoxite short, rounded; tooth on gonostylus wide, coarsely serrated; aedeagus wide distally in lateral view; hypoproct with thin lobes, much shorter than aedeagus.

Female

Unknown.

Pupa (Figs 24-26)

Total length 3.9 mm (3.7 - 4.1). Antennal horns 82 µm (51 - 115) long. Cephalic setae 147 µm (137 - 165) long. Cephalic swellings 25 µm (20 - 29) long. Upper face with pair of sclerotized protuberances, 31 µm (25 - 38) long. Setae on lower facial papillae 38 µm (32 - 45) long. Prothoracic spiracle bowed at distal third, 190 µm (174 - 209) long, trachea ending at apex. Otherwise as in *O. schwarzi*.

Larva (Figs 31-34)

Colour: pink to orange. Total length 4.4 mm (3.7 - 5.0). Head capsule width at base 99 µm (95 – 102), length 76 µm (69 - 81). length of postero-lateral apodemes 125 µm (100 - 141). Antenna 24 µm (24 - 25) long. Sternal spatula 425 µm (398 - 475) long, with apical enlargement 127 µm (108 - 154) wide, depth of incision 54 µm (50 - 59). Terminal lobes 148 µm (121 - 160) long.

Etymology

The name "flabellidentata" is a compound Latin adjective from "flabellum", meaning fan, and "dentatus", meaning toothed, refering to the shape of the tooth on the gonostylus.

Gall and biology

Young branches of *Eucalyptus cosmophylla* are swollen to form galls 10 - 70 mm in length and 10 - 15 mm in diameter, with outer walls 2 - 4 mm thick (Fig. 2). The gall outer surface is smooth to scabrous, green to brown in colour. Inside there are 1 - 4 irregularly-shaped chambers, each occupied by 5 - 15 larvae. Pupation takes place in the soil. The galls remain recognisable on the branches for several years after they have been formed. Many branches later fracture at the site of the gall since the gall tissue is less rigid than that of the tree. The same phenomenon was observed in *O. schwarzi*. The galls of *O. flabellidentata* on *E. cosmophylla* are common in the nature conservation parks around Adelaide.

Remarks

The two new species differ from each other in several characters. The males of *Okubomyia schwarzi* have a narrow tooth on the gonostylus, the hypoproct is as long as the aedeagus, the gonocoxite has two thin, posterior lobes dorso-medially, and the apico-ventral lobe on the gonocoxite is aciculate. The males of *O. flabellidentata* have a wide tooth on the gonostylus, the hypoproct is much shorter than the aedeagus, the gonocoxite has no posterior lobes dorso-medially but has one thin and one wide lobe dorsally, and the apico-ventral lobe on the gonocoxite is short and rounded. The pupae of *O. schwarzi* have two pairs of sclerotized protuberances on the upper face, long setae on the lower facial papillae, and an evenly-bent prothoracic spiracle. The pupae of *O. flabellidentata* have one pair of sclerotized protuberances on the upper face, short setae on the lower facial papillae, and a distally bowed prothoracic spiracle.

That as many as 12 males and no females were reared from the one gall on *Eucalyptus cosmophylla* collected 23.iii.1997 suggests that females of *O. flabellidentata* produce unisexual progeny, a phenomenon found in *Contarinia sorghicola* (Coquillett) (Baxendale & Teetes 1981) and *Cystiphora sonchi* (Bremi) (McClay 1996). In order to verify the production of unisexual progeny in *O. flabellidentata*, and perhaps *O. schwarzi*, more adults have to be reared from separate galls. This may require rearing larvae from a larger number of galls as *O. flabellidentata* seems not to be an easily reared species. From some 150 larvae originating from 10 galls included in this work only the 12 males emerged.

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